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Agricultural Memorandum No. 887.

TWIN LAMBING

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Introduction

Bastiman (1974) showed that significantly higher lambing percentages were recorded from inwintered ewes. It was suggested that foetal resorption, especially in twins, was the cause of this difference. These resorptions appeared to be associated with periods when the pregnant ewe experienced sub-zero conditions, see Figure 1.

L.P. Smith, Agricultural Memoranda Nos. 214 and 259, tried to estimate the percentage of twin lambs that would be born in the coming season by looking at the state of the pasture at and prior to "tupping". He estimated the grass growth by examining the balance between the rainfall and evaporation from the grass during the period May to August. He also allowed for a "climatic stress factor" on the grass growth. For the majority of years that data were available a reasonable prediction of twinning was found using:-

$$\text{Estimated Twinning Percentage} = 13.8 - 0.27U - 0.24\,V$$ [Hereafter refered to as "Original"]

Where $U = \dfrac{100\ (\text{May + June actual evaporation})}{(\text{July + August actual evaporation}).\ (\text{May + June + July + August actual evaporation})}$

$V =$ (July + August Rainfall) - (July + August potential evaporation)

However for some years the predicted values for twinning were in error (see Table 2). These errors may have been introduced by many factors among which are:-

(1) only a weak relationship between the grass growth and the final twinning

(2) lack of statistical data or

(3) an intermediate factor such as that of resorption observed by Bastiman (1974).

The object of this Agricultural Memorandum is twofold; firstly to check the validity of the equation derived in Agricultural Memorandum No.259 on some more recent data from the same source and secondly to examine the data to determine if there is any link between the years when the estimated value of twinning was in error and the meteorological conditions experienced by the pregnant ewes.

Validation of the twinning equation

Five years of data, not included in the original Agricultural Memoranda, see Table 1, have been provided by the Central Veterinary Laboratory, Weybridge, to test the validity of the twinning equation.

Prior to using these new data two checks were performed on the original data. Firstly an attempt was made to derive some of the 'U' and 'V' values that had actually been used in the derivation of the equation. Using the method described in the relevant Agricultural Memoranda the exact figures could not be reproduced. Values fairly close to the original were obtained but it was inadvisable to use these when checking the equation with new data. Secondly the data, as presented, were re-analysed using the Bio Medical Statistical Package, available on the Meteorological Office Computer. The best fit to the data was:-

Estimated Twinning % = 13.17 - 0.24 U [Hereafter refered to as "MOD ORIGINAL"]

The significant feature that emerged from this analysis was that there was very little statistical significance in the term V. The predicted and actual values for the twinning percentage for both the ORIGINAL and MOD ORIGINAL are shown in Table 2.

In an attempt to make all of the twinning data directly comparable new values for U and V were derived using average rainfall data for the three sites, Wrexham, Ruthin and Harwarden Bridge, and the actual evaporation derived from the Grindley (Penman) Soil Moisture Deficit Model (1969). The values for U and V and the resultant twinning estimates using the associated twinning equation are shown in Table 3. The new twinning equation is:-

Estimated Twinning % = 13.06 - 0.19 U [Hereafter refered to as NEW]

Table 4 shows a summary of the estimated twinning percentages using the ORIGINAL, MOD ORIGINAL and NEW equations. This table shows that although all three methods give similar results the ORIGINAL method is slightly more accurate.

Table 5 shows the observed and estimated twinning percentages using the most recent data and the NEW equation.

Finally the whole of the data were re-analysed and the final prediction equation is:-

Estimated Twinning % = 12.44 - 0.18 U

Table 6 shows the results from this equation.

Departure from estimated values

If the resorption effect, observed by Bastiman (1974), is generally applicable some of the errors shown in the previous section may be explicable. Any problem that the pregnant ewe encounters, after a successful tupping, will lead to a reduction in the number of lambs born. Consequently, if resorption caused by a period of cold stress is relevant it would not seem unreasonable to find that the years when the estimated value for twinning was higher than the measured were years which experienced harsher weather conditions during the critical period of early pregnancy. Bastiman (1974) indicated that night minimum temperatures were the possible clue to resorption. The data for Ruthin were examined and no direct correlation could be found between the total number of night minimum temperatures, in the period September to December in various ranges, and the relative failure of the predictive equation or even the actual number of twins born and the minimum temperatures.

Agricultural Memorandum No 867 demonstrated the combined effect of precipitation, windspeed and temperature on young lambs. Whilst these are not directly appropriate to adult sheep it demonstrates that a combination of the three parameters is

important. An adult ewe, adapted to the rigours of mountain life will certainly not succumb to the conditions described for young lambs, it may be postulated that the delicately balanced pregnancy support system may be affected by them. To check this hourly meteorological data are required. Unfortunately this data are not available for the Denbighshire area and consequently the hypothesis cannot be tested.

Conclusion

There is a distinct advantage, from the farm management point of view, in knowing, in advance, the likely number of twin lambs that are to be born. The work described here has shown that the twinning percentage can be estimated to about ± 2%. This method gives a factor of two better estimate than simply using the average twinning percentage as a predictor. However, the present system, does not allow one to pick out, with confidence, the years which are going to cause specific problems for the farmer and hence is of little operational value.

References:

Bastiman, B. (1974) Inwintering of ewes: Part IV. Effect of weather conditions. Experimental Husbandry 27, 104-113.

Grindley, J. (1969) The calculation of actual evaporation and soil moisture deficit over specified catchment areas. Appendix to Hydrological Memorandum No 38. Meteorological Office, Bracknell, Berkshire.

Any comments or suggestions on this paper should be refered to the authors.

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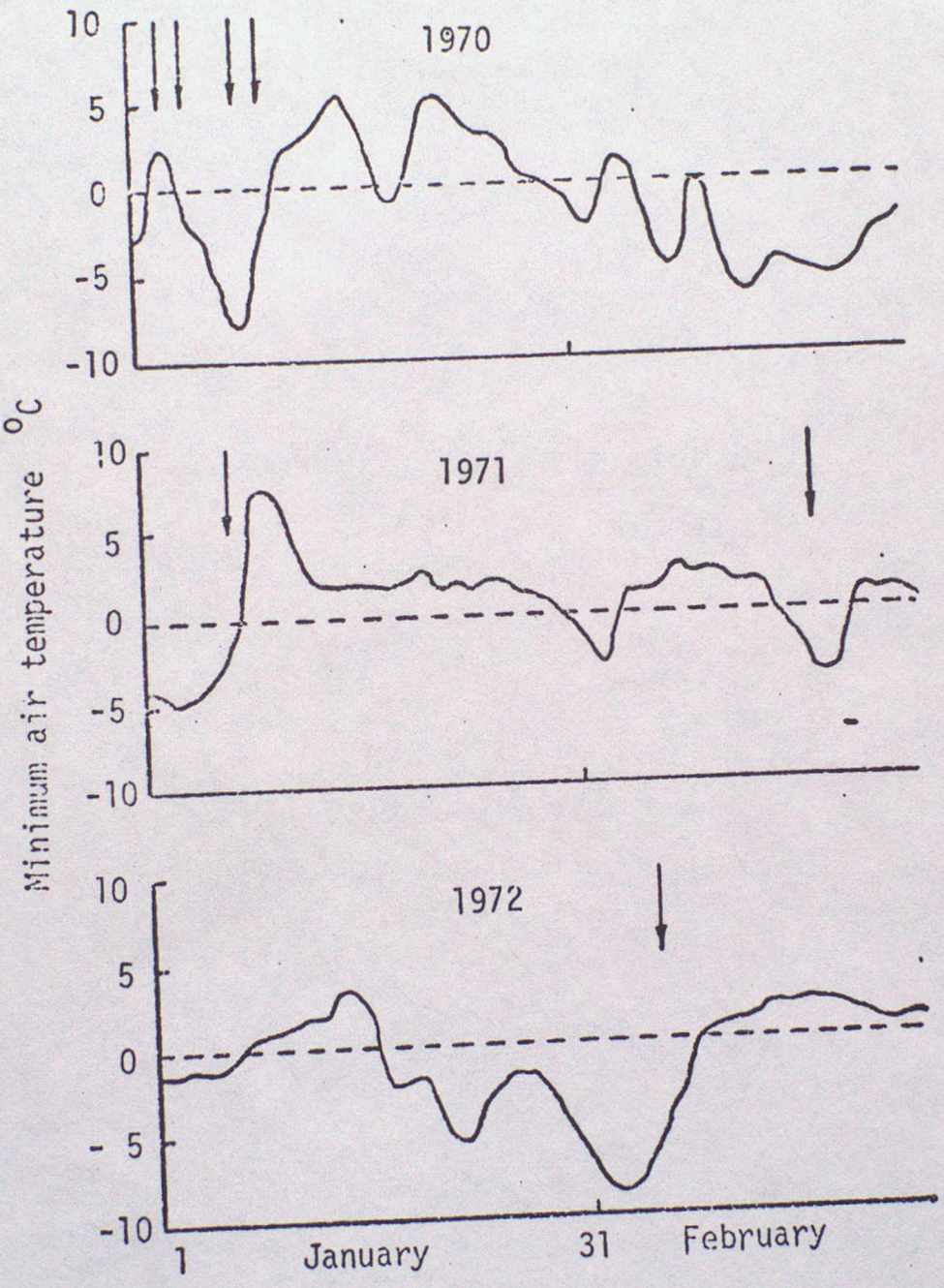

Figure 1. Relationship between air temperature and foetal resorption.

Table 1. Denbighshire Twinning Data [data from 20,000 ewes]

	1966	1968	1969	1970	1971
Percentage Twinning	10.1	11.2	10.3	8.7	9.8

Table 2. Twinning Comparison: Actual, ORIGINAL and MOD ORIGINAL

Year	Actual Twinning %	Original Twinning %	MOD ORIGINAL Twinning %
1954	9.7	10.7	10.8
1955	6.6	6.5	6.6
1956	10.4	10.8	11.6
1957	11.1	11.0	11.5
1958	12.2	11.0	11.1
1959	10.0	9.9	9.7
1960	12.8	11.9	11.6
1961	11.4	12.1	11.6
1962	12.4	10.7	10.4
1963	9.0	9.9	9.6
1964	9.1	10.5	10.2

Table 3. Twinning estimate using New method

Year	New Twinning Estimate
1955	6.6
1956	11.6
1957	11.9
1958	11.7
1959	10.4
1960	10.9
1961	11.3
1962	10.5
1963	10.0
1964	10.0

Table 4. Comparison of the ORIGINAL, MOD ORIGINAL and NEW methods for estimating the twinning percentage

	ORIGINAL		MOD ORIGINAL		NEW	
Year	Estimate	Error^2	Estimate	Error^2	Estimate	Error^2
1954	10.7	1.0	10.8	1.21		
1955	6.5	0.01	6.6	0	6.6	0
1956	10.8	0.16	11.6	1.44	11.6	1.44
1957	11.0	0.01	11.5	0.16	11.4	0.64
1958	11.0	1.44	11.1	1.21	11.7	0.25
1959	9.9	0.01	9.7	0.09	10.4	0.16
1960	11.9	0.81	11.6	1.44	10.9	3.61
1961	12.1	0.49	11.6	0.04	11.3	0.01
1962	10.7	2.89	10.4	4.0	10.5	3.61
1963	9.9	0.81	9.6	0.36	10.0	1.0
1964	10.5	1.96	10.2	1.21	10.0	0.81
1965 *	11.2	1.00	11.2	1.00	11.6	1.94
1967 *	10.7	1.96	10.3	1.00	10.9	2.46
	$\frac{\text{ERROR}^2}{\text{Number of years}}$	= 0.97	$\frac{\text{ERROR}^2}{\text{Number of years}}$	= 1.0	$\frac{\text{ERROR}^2}{\text{Number of years}}$	= 1.3

Table 5. Comparison of New data on New method for estimating the twinning percentage

Year	Actual Twinning %	Estimated Twinning %
1966	10.1	11.1
1968	11.2	11.3
1969	10.3	11.0
1970	8.7	10.5
1971	9.8	11.2

* original data which was used to check the twinning equation.

Table 6. Best estimate of Twinning Percentage using all of the available data

Year	Actual Twinning %	Estimated Twinning %
1955	6.6	6.5
1956	10.4	11.1
1957	11.1	11.3
1958	12.2	11.2
1959	10.0	10.0
1960	12.8	10.4
1961	11.4	10.8
1962	12.4	10.1
1963	9.0	9.6
1964	9.1	9.6
1965	10.2	11.0
1966	10.1	10.6
1967	9.3	10.3
1968	11.2	10.8
1969	10.3	10.5
1970	8.7	10.0
1971	9.8	10.7

Table 7. Night Minimum Temperatures (Number of occasion between fixed limits)

Year	0 to -1.99	-2.0 to -3.99	-4.0 to -5.99	-6.0 to -7.99	-8.0 to -9.9	<-10.0
1959	9	0	1	0	0	0
1960	11	8	2	0	0	0
1961	11	9	2	2	1	2
1962	14	7	3	2	0	3
1963	14	3	4	1	1	0
1964	10	7	4	0	1	1
1965	12	6	2	2	1	0
1966	8	1	1	0	0	0
1967	10	6	3	1	0	2
1968	7	3	2	4	0	0
1969	17	14	1	1	0	2
1970	13	4	1	0	0	0
1971	0	0	0	0	0	0
Average	10.5	5.2	2.0	1.0	0.3	0.8